

REMARKS/ARGUMENTS

Claims 9-26 are pending in the present application. Claims 1-8 had been previously withdrawn and canceled without prejudice. Claims 9-26 stand rejected under 35 USC 103(a). Claim 9 has been amended to clarify that the photovoltaic block copolymer is conjugated and this amendment is supported by, among other things, ¶ [0045]. Claim 26 has been amended to correct a typographic error in reference to bridge-acceptor units consistent with the preceding wording within that claim. No new matter has been added.

I. Interview of April 02, 2008

Before remarking on the Office Action, the Applicant wishes to express appreciation for the courtesy extended by Examiners Hall and Neckel during the telephone interview on April 02, 2008. During the interview, definition of “block copolymer” was discussed, along with a discussion of the cited references. The amendments and remarks herein are intended to be substantially in accordance with those discussions during the interview.

In summary, the Applicant described polymers as large molecules (i.e., typically having molecular weight of at least 5000 Daltons) that contain repeating structure units called monomers. Copolymers are those polymers that contain at least two different kinds of monomers. While block copolymers are those copolymers that contain at least two different polymer blocks (i.e., made of different monomers) on the backbone. Given this understanding, the Applicant was unable to locate a disclosure of “photovoltaic conjugated block copolymers” within the cited references.

Examiner Hall also mentioned the reference “Supramolecular self-assembly and opto-electric properties of semiconducting block copolymers,” to Boer,...and Hadziioannou. This reference had been discussed in ¶ [0022] of the present application, and is not a direct citation of the present office action. However, the Applicant noted that the polystyrene/C₆₀ acceptor block

technology of that reference had been abandoned due to poor electron mobility and, although referencing block copolymers, it did not disclose a “photovoltaic conjugated block copolymer.”

II. 35 USC 103(a) Rejections

Introduction

The present application relates to photovoltaic conjugated block copolymers, including methods and devices for their use. As noted above, a “photovoltaic conjugated block copolymer” is a polymer whose main chain or backbone is composed of different or distinct segments or blocks, with each block having a unique monomer repeat unit and chemical structure, and the different blocks are connected via covalent chemical bonding. See, e.g., Claim 9, Specification ¶¶ [0022] – [0023]. A donor type of conjugated polymer (**D**) may be chemically or covalently connected with an acceptor type of conjugated polymer (**A**) via non conjugated bridge (**B**) chains to form a D-B-A, or D-A-B type block polymers. Id. This mechanism of connecting block copolymers differs from the relationship of the donor and acceptor components within a blended mixture or composite. Thus, conjugated here means the polymer main chain contains alternating single and double chemical bonds, and is relatively rigid.

Claims 9-17, 25, 26

The office action rejected claims 9-13 under 35 U.S.C. § 103(a) over Thompson (US 6,107,561) in view of Maekawa et al. (US 5,565,607). The office action further rejected claims 14-17 and 25-26 over Thompson in view of Maekawa and in view of additional references. The Applicant respectfully submits that, among other elements, neither Thompson, Maekawa, or the additional cited references disclose the element of “photovoltaic conjugated block copolymer samples,” as asserted within the office action. See, e.g., Claim 9.

Thompson is directed to several small organic-metal complex molecules that are unrelated to block copolymers. See, e.g., col. 1, lines 9-11, 51-57. In addition, the synthetic methods involved are different, such that the synthetic methods used appropriate for the

molecules of Thompson will not work for block copolymers. Thompson makes incidental reference to use of a polymer template as a linking means to “hydrophobic substrates (e.g., quartz, silicon, and metals),” but fails to disclose photovoltaic conjugated block copolymers. See, e.g. Col. 8, ll. 27 et seq. Thompson also references a “conjugated network,” which is a conjugated ring type of chemical structure, such as porpharines that are common in natural plants. This is scientifically different from a photovoltaic conjugated block copolymer, which is a non-network linear type chemical structure.

Similarly, the disclosure of Maekawa is directed to traditional copolymers, but not a photovoltaic conjugated block copolymer; quoting from Maekawa: “[t]he present invention also provides polymer of the polyfluorocarbon group-containing acrylate of the formula (1) or a copolymer of such an acrylate with other copolymerizable monomer, and a process for production thereof.” Col. 4, ll. 4-8. The synthetic methods of Maekawa are also different from that of the photovoltaic conjugated block copolymer of the present invention.

Claims 10-17, 24-25 depend from claim 9 and incorporate the element of “photovoltaic conjugated block copolymer” missing from the cited references. Even if a single claim limitation is not taught or suggested by the cited art, then that claim cannot be obvious. Application of Glass, 472 F.2d 1388, 1392 (C.C.P.A. 1973). For this reason, Applicant respectfully requests that the rejection of claims 9-17, 24-25 under 35 U.S.C. § 103 be reconsidered and withdrawn.

Claims 18 – 24

Claims 18-21 were rejected under 35 USC 103(a) as being unpatentable over Brabec, et al., (“Origin of the Open Circuit Voltage of Plastic Solar Cells,” *Advanced Functional Materials*, Vol. 11, Issue 5, pages 374-380 (2001), in view of various other citations for the above referenced claims. The Applicant respectfully submits that, among other elements, Brabec and the associated cited references fail to disclose the element of a “...synthesizing a photovoltaic block copolymer from conjugated donor chains and non-conjugated bridge chains” (Claim 18) or

“...synthesizing a photovoltaic block copolymer from conjugated donor chains, conjugated acceptor chains and non-conjugated bridge chains.” (Claim 22)

Instead, Brabec, et al., discloses the synthesis of four (4) C₆₀ derivatives used as acceptor moieties. That is, Brabec discusses a donor type of polymer (e.g., MDMO-PPV) that is physically blended or mixed with four different acceptor types of fullerene derivative molecules (Azafulleroid 5, ketolactam 6, PCBM, and C60) each. See Brabec, pp. 374-375 (¶ 1). The solar cell devices were “produced by doctor blading the active layer donor-acceptor composite from toluene solutions...” Brabec, p. 376 (¶ 2.3.1)(emphasis supplied).

The other references cited do not supply this missing element. The citations of Sethuramen, et al., Nava, et al., Hummelen, et al., and Kawakami, et al. do not disclose the use of photovoltaic conjugated block copolymers. Sethuramen, et al. is directed to cleaning particles from a semiconductor topography that was polished with a fixed-abrasive polishing process. Any photovoltaic polymers disclosed within the citations relate to structures other than block copolymers. The publication to Nava, et al., discloses “interpenetrating blends of donors and acceptors” having “heterojunctions.” See Nava, et al., p. 1586. The publication of Hummelen, et al. discloses a donor type of polymer that is physically mixed with an acceptor type of molecules (e.g., PCBM) to form a “blend” having “heterojunctions,” (i.e., like that in Brabec, et al.), and solar cells fabricated from such blend materials. See Hummelen, et al., pp. 76-77.

Applicant further respectfully submits that Brabec, et al., Hummelen, et al., etc. teach away from the present invention. The phase separation of different blocks in block copolymers are controlled or constrained at the molecular or block segment level; this aspect yields a different category of nano-structures from the photovoltaic conjugated block copolymers claims 18 and 22. In contrast, the phase separation of different polymers in a blend or composite mixture is random and uncontrollable. A blend or mixture would necessarily not require the steps of connecting copolymers that are disclosed and claimed in claims 18-24. Conversely, a blend or mixture would remove the controlled or constrained aspects of the block copolymers of the present invention. See, e.g., Specification ¶ [0039].


Claims 19-21 depend from claim 18, and claims 23-24 depend from claim 22, and all involve the synthesizing of photovoltaic conjugated block copolymers. Even if a single claim element is not taught or suggested by the cited art, then that claim cannot be obvious.

Application of Glass, 472 F.2d 1388, 1392 (C.C.P.A. 1973). For this reason, Applicant respectfully requests that the rejection of claims 9-17, 24-25 under 35 U.S.C. § 103 be reconsidered and withdrawn.

III. Conclusion

The applicant respectfully submits that all claims, namely claims 9-26 are patentably distinguishable over the art applied. Accordingly, applicant respectfully requests that a Notice of Allowance be issued in this case. Should the Examiner not agree, then a telephone interview is respectfully requested to discuss and to resolve any remaining issues in allowance of this application.

Respectfully submitted,



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Appendix A

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